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ABSTRACT

This report examines performance differences between Asian, Black, Hispanic, and White students in Delaware on the mathematics portion of the Third International Mathematics and Science Study-Repeat (TIMSS-R). Data analyses show that the mathematics performance gap across ethnic groups is significant. The lowest 100 Black and White performers were scoring well below all international benchmarks. Different student groups had different strengths across the various mathematics strands. There was a significant performance gap between the top 20 Black and White performers. The top performers' teachers all had degrees in the field of mathematics or mathematics education, and the majority also hold master's degrees. Several examples of TIMSS-R problems are included together with statistical data. (KHR)

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Differential Mathematics Performance on the TIMSS-R Across Delaware Students of Color.

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INTRODUCTION

The first set of research studies (www.rdc.udel.edu) focused on the Delaware Science Coalition's performance on the Third International Mathematics & Science Study - Repeat (TIMSS-R) indicated there are performance differences across students with various ethnic backgrounds on both the TIMSS-R and the Delaware Student Testing Program (Cwikla, 2001). The recently released TIMSS-R data allows students to be aggregated by ethnicity as well as across mathematics content strands. This technical report will detail performance differences across Asian, Black, Hispanic, and White students in Delaware on the mathematics portion of the TIMSS-R.

COMPARISON ACROSS MATHEMATICS STRANDS

Figure 1 reports Delaware students' performance across ethnicity and are compared to the national averages. The performance gap across Black and White students in Delaware is 66 points while the national Black-White gap is over 100 points.

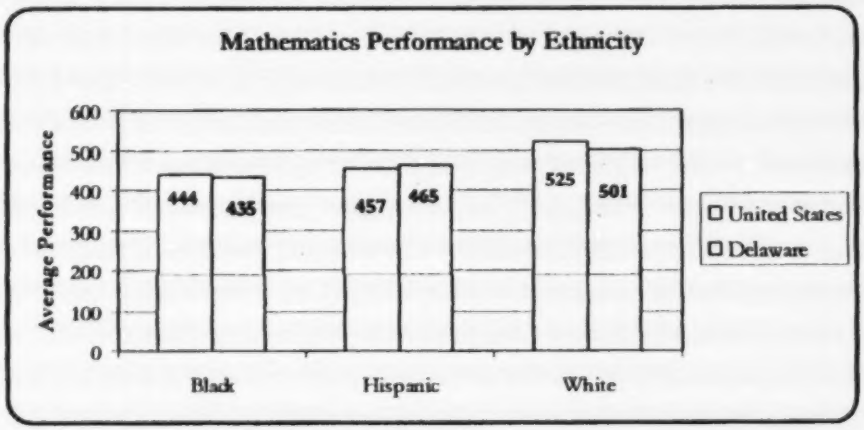

Figure 1: Performance by ethnicity: Delaware vs. U.S.

To better understand each group's total mathematics score, performance data across each of the mathematics strands was computed. These data are displayed in Figure 2. The ethnic groups are arranged in order of size in the state of Delaware. The following can be observed from the data:

- Largest performance gap between Black & White students is in the measurement strand
- Lowest Black student performance in Measurement
- Lowest Asian student performance in Probability
- Highest Asian student performance in Measurement and Geometry
- Hispanic students perform their best in Algebra.

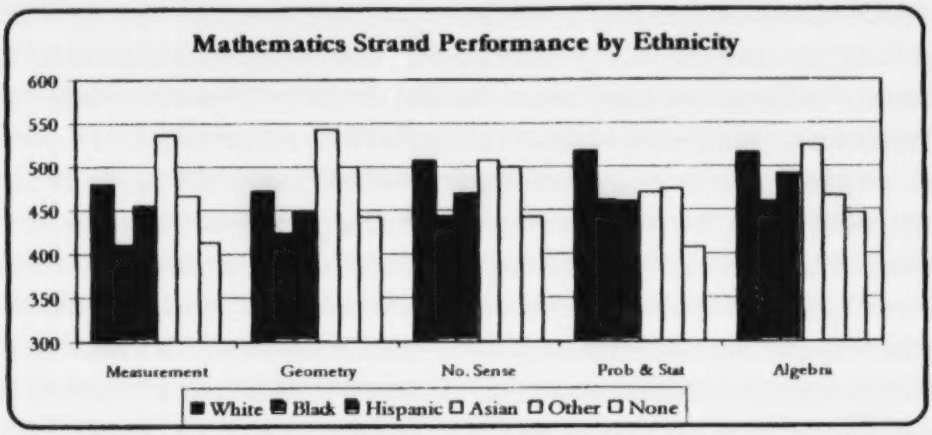

Figure 2: Strand performance across ethnicity.

The differences across ethnicity are not consistent over the various areas of mathematics. In other words, Black students are not consistently lower than Whites by the same amount in each strand and likewise Asian students are not consistently higher in every area. This suggests two possible issues: (1) students of different ethnicities are being prepared or supported differently in the classroom or (2) students with different backgrounds present different cognitive profiles, strengths and weakness as a result of social experiences in their school, community and home.

The TIMSS-R data can not provide possible guidance in this area, nor can students be aggregated based on their economic status. However, the Center on Education Policy examined the National Assessment of Educational Progress (NAEP) and stated that the achievement gap is "not due to differences in innate ability, nor is it simply the result of biased test questions" (Kober, 2001). The report concluded that after aggregating students by ethnicity and family income that although differences in economic status contribute to the achievement gap, they do *not* entirely explain the performance gap.

Top 20 Black & White Performers

To further investigate performance across ethnicity, the two largest student groups, Black and White were isolated for analyses. These students represent 3% of the Delaware eighth graders tested. The top 20 Black and White performers were identified and their performance across mathematics strands is summarized in Figure 3. There are significant differences across the top students in each of these groups with White students outperforming the Black. Similar to the overall Delaware performance the differences are not consistent across strands. For example, the top 20 Black students averaged 513 points in Geometry while the White students averaged only about 40

points higher. Meanwhile, in Probability and Statistics the White students score more than 100 points higher than their Black peers.

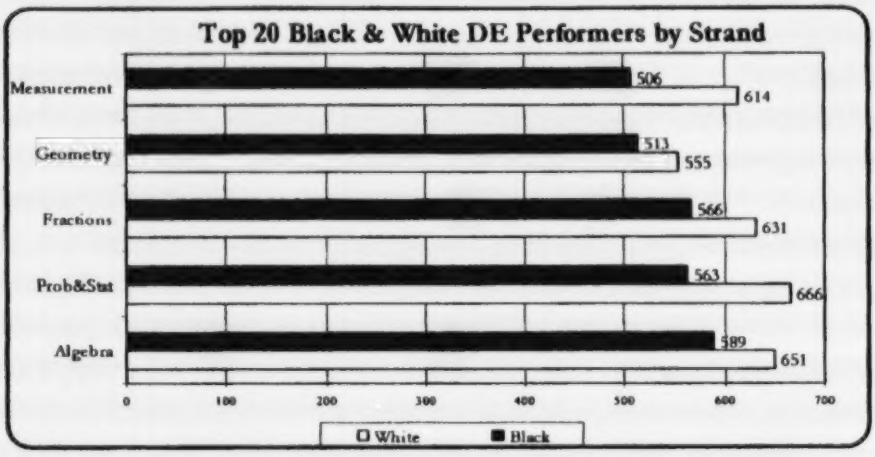

Figure 3: Top Black & White performers.

When compared to the United States average in Figure 4, not surprisingly the top 20 Black and White Delaware performers score significantly higher than the average U.S. student. However the gap is probably not as large as some might have thought.

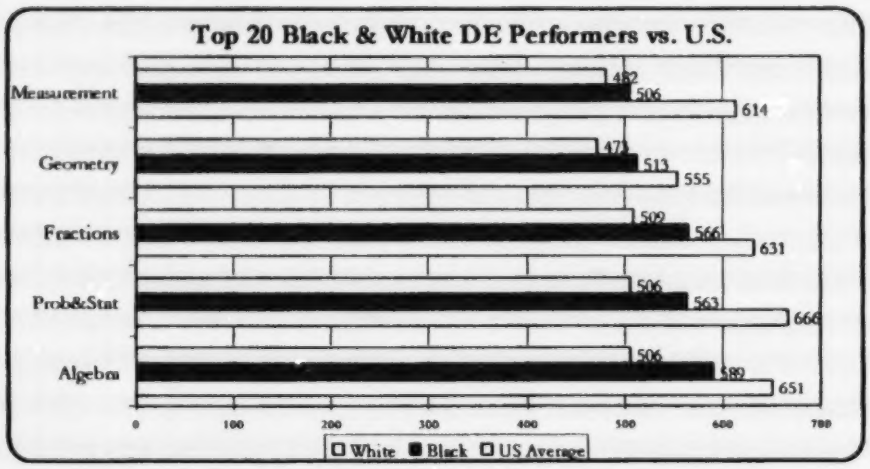

Figure 4: Top Delaware students vs. the U.S.

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TOP PERFORMERS' TEACHERS

To learn more about these top performers' learning environments, the student data were linked with the descriptive data about their teacher. Surprisingly, the 40 top performers in the state are taught by only 13 mathematics teachers. This means there are clusters of top performers in these 13 of the 50 classrooms included in the TIMSS-R and their high performance is attributable to either an effective teacher and/or the tracking of high performers.

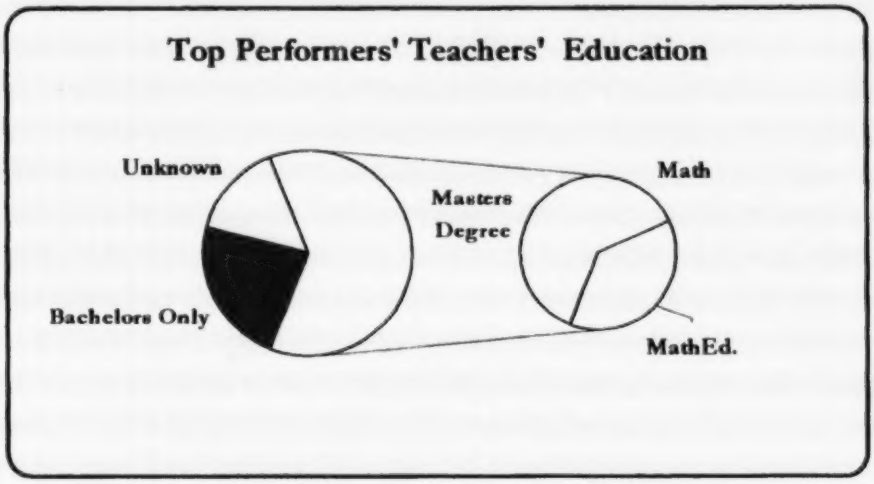

Figure 5: Teachers' Education

Firstly, these teachers' educational background was examined. Most of Delaware's top performers were taught by teachers who hold a masters degree in mathematics or mathematics education (See Figure 5). Secondly, the teachers' characteristics including their years of experience, number of top performers in their classroom, ethnicity, and field of study are reported in Table 1 below.

- There is no consistency with regard to years of teaching experience. This is most prominent with the teacher who taught 8 of the top 40 performers with only 1 year of teaching experience.
- The teacher population in Delaware is predominantly White and it is therefore not surprising that all of these 13 teachers are White. These teachers represent 26% of the Delaware teacher population included in the TIMSS-R.
- The most notable result is that nearly all the teachers of top performers have degrees in **mathematics** or **mathematics education** and the majority of these teachers hold master's degrees. This is not typical of most Delaware 8th grade teachers' educational background (Cwikla, 2001).

Table 1: Top Performers' Teachers' Educational Background

Number of Top Performers per Teacher	Student Ethnicity	Highest Degree Earned	Teaching Experience	Teacher Ethnicity
8 Students	0 Black 8 White	Bachelors – Mathematics Masters – Mathematics	1 Year	White
4 Students	4 Black 0 White	Bachelors – Math Education Masters – Math Education	20 Years	White
4 Students	3 Black 1 White	Bachelors – Math & Education	4 Years	White
4 Students	3 Black 1 White	Bachelors – Mathematics Masters – Math Education	22 Years	White
4 Students	3 Black 1 White	Unknown (2 Teachers)	Unknown	White
4 Students	2 Black 2 White	Bachelors – Mathematics Masters – Education	12 Years	White
3 Students	1 Black 2 White	Bachelors – Math Education Masters – Math Education	16 Years	White
3 Students	0 Black 3 White	Bachelors - Mathematics Masters – Education	31 Years	White
2 Students	1 Black 1 White	Bachelors – Mathematics	18 Years	White
2 Students	1 Black 1 White	Bachelors - Mathematics Masters – Math & Education	30 Years	White
1 Student	1 Black 0 White	Bachelors – Mathematics Masters – Math Education	29 Years	White
1 Student	1 Black 0 White	Bachelors – Mathematics	2 Years	White

LOWEST PERFORMERS

After examining the top performers, I thought it useful to also examine the lowest Delaware performers as well. The 100 lowest performing Black and the 100 lowest White performers were chosen to compare (See Figure 6). In both cases students perform their best in Algebra and their worst in Measurement. Still an achievement gap exists. However, the gap is smaller than it is compared to the differential performance across the top 20 students from each group. Yet, this is no consolation, since these students are all scoring below all international benchmarks in the bottom 25th percentile.

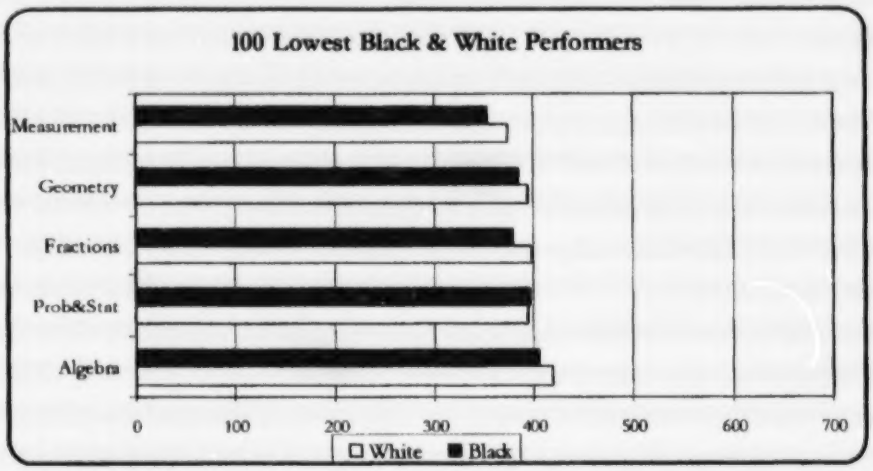

Figure 6: The 100 lowest performers from each group.

These 200 lowest performing students, 100 from each group were taught by 37 mathematics teachers. Ninety-four of the students were taught by 14 teachers with only a bachelor's degree, 8 in mathematics and 6 in education. Sixty-four of the lowest performing students were taught by 14 different teachers with masters' degrees in mathematics or mathematics education. The remaining 42 students were taught by teachers who did not report their degree or major. There are only two teachers that taught both top performing and bottom performing students. Mathematics teachers' background and their student performance will be explored more in depth in a forthcoming report focused on teacher preparation and student performance.

INTERNATIONAL BENCHMARK PERFORMANCE AND ETHNICITY

Lastly this study examined the international benchmark performance for Delaware's students with attention to students' ethnicity. Figure 7 displays the distribution of Delaware students at each of the benchmarks. The majority of the students tested are performing at the lower or median

benchmarks. Less than 5% of Delaware's students are performing in the 90th percentile and 15% of Delaware's students did *not* meet *any* of the international benchmarks.

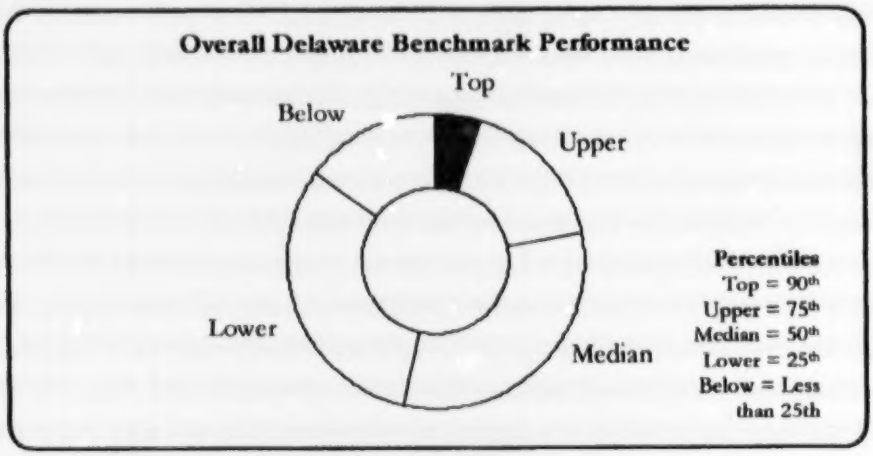

Figure 7: International benchmark performance.

The Delaware student population is 63% White, 24% Black, 5% Hispanic, 2% Asian, and the remainder is Alaskan, Native Americans, and Other. There were 1268 Delaware students assessed with 1262 scores reported. Sixty-three Delaware students or 4.9% of those tested performed at the top international benchmark or in the top 10% of all eighth grade students tested worldwide (See Figure 8).

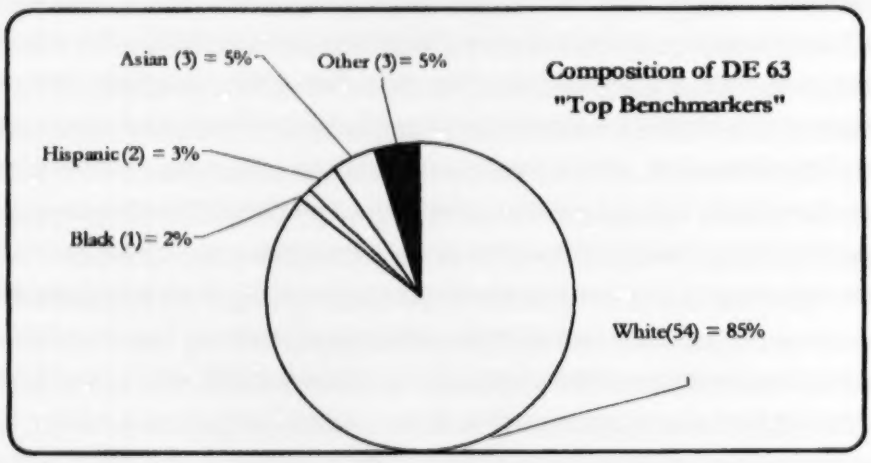

Figure 8: Composition of top benchmarking students in Delaware.

The composition of this group of students is described in the figure above. Of the 63 students in the 90th percentile, 1 student is Black. And only 9 of the 63 top performers are students

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of color despite the fact they represent 37% of the Delaware eighth grade population. The top 20 Black and White performers examined in the previous section of this report overlap with the 40 White students in this Top Benchmarking group, but with only 1 Black student represented.

The results are predictably opposite for the students that did not perform at the lower benchmark and hence are well below all benchmarks. There are 183 students or 15% of the Delaware eight graders tested who are not meeting any of the international benchmarks and performing below the 25th percentile. Moreover, almost half of these students are Black (See Figure 9).

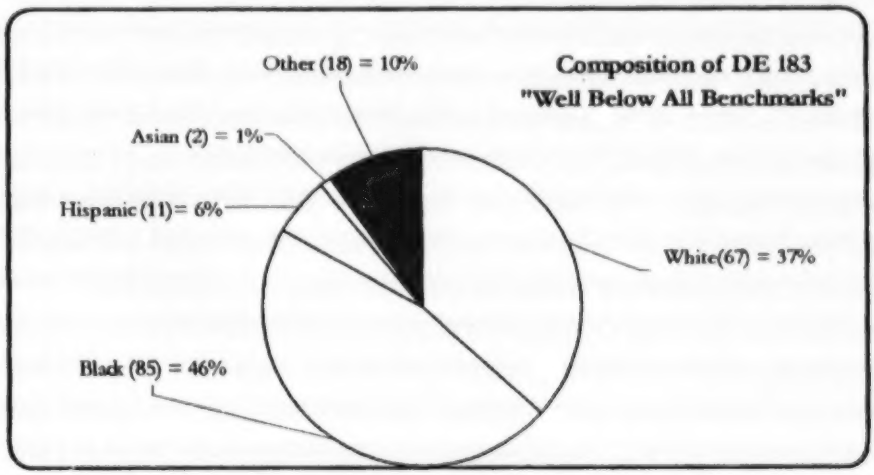

Figure 9: Composition of below benchmark students in Delaware.

CONCLUSIONS

A summary of these data analyses follow.

- The mathematics performance gap across ethnic groups is significant.
- Different student groups have different strengths across the various mathematics strands.
- Black, Hispanic, and White students performed their best in Algebra.
- Asians performed their best in Geometry.
- There is a significant performance gap between the top 20 Black and the top 20 White performers.
- The top performers' teachers all have degrees in the field of mathematics or mathematics education and the majority, also hold masters degrees.
- The lowest 100 Black and 100 White performers are scoring well below all international benchmarks.

- Less than 5% of Delaware's students are performing in the top 10% internationally.
- Of those top 5% one of the 63 students is Black.
- 15% of Delaware students tested performed below *all* international benchmarks and students of color are over represented in this group.

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